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THOS. L. CASEY.

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In the "Structural and Systematic Conchology" of Tryon, the family Pleurotomidae is restricted to two genera — *Pleurotoma* and *Halia*. The latter of these being somewhat doubtful in its relationship, we may assume that in the original opinion of Tryon the family Pleurotomidae is made up of the single genus *Pleurotoma*, which he separated into a number of named groups relegated to subgeneric rank. Now while perfectly true that, with our present lights, well-nigh insuperable difficulties beset us in striving to define isolated aggregates of species and classify them in a satisfactory manner, it none the less appears to the writer that the course suggested by Tryon was unphilosophic. Although there seems to be scarcely any limit to the number of genera that might be provisionally admitted — a recent study of rather more than 600 species living and fossil, most of which are in my cabinet, apparently indicating nearly or quite 250 genera, based principally upon embryonal structure, form and position of the anal sinus, form and extent of the canal and general type of sculpture — that is no adequate reason for holding all this diversification of structure and evidence of adaptation to greatly varied environments among at least 3000 species, from the Cretaceous to the present time, to be comprised within a single genus. Later, in the "Manual of Conchology," Tryon considerably modified his original views and admitted several distinct genera which he assigned to sundry groups held to have subfamily rank, but, in this case, it would appear that he rather overestimated the taxonomic importance of certain genera. Granting that the family under consideration comprises only the two genera *Pleurotoma* and *Halia*, as originally

held by Tryon, it would seem more natural to regard these genera only as the representatives of subfamilies — Pleurotominae and Haliinae — which alone would compose the Pleurotomidae. It is possible, however, if not highly probable, that some of the originial subgenera of Tryon, such as *Donovania* (*Lachesis*) and *Mitromorpha*, may really rank as subfamilies or even belong to widely different families.

Probably the course coming nearest to the truth of the matter would be to treat the Pleurotomidae in accordance with the common practice in equally extensive and complex families of arthropods and other classes of animal life, — that is to divide the family or subfamily into tribal sections, each of which is to be separated into more or less definitely limited groups of species which may be known as genera and comprising also, in some special cases, other minor groups or subgenera. The alternative course and the one usually followed in the literature of the Mollusca, would be to divide the families or subfamilies into a comparatively small number of genera, to which a relatively very large number of minor groups are to be attached as subgenera. In the latter case I find it impossible to scientifically define these supergenera, and another objection to this alternative method is that it gives rise to too cumbrous a nomenclature. In the present state of ignorance of true relationships and exact taxonomic weights or values, a name once printed and introduced to nomenclature may as well be regarded as the true surname of the species as of subordinate value, for a subspecies under the latter condition must be represented by four words, and, instead of adhering to the binomial system, we would be shaping a course strongly suggestive of a reversion to the pre-Linnean custom of descriptive names or short descriptive diagnoses and the manifest advantages of the binomial system would be thrown away. It is impossible to devise a system of nomenclature which will serve to indicate at a glance, by the form of the names, exactly the weight or value of taxonomic relationship or isolation and it may as well not be attempted. When we print a tabular statement of species or genera based upon structural characters, we do not by any means desire it

to be understood that the differences between these species or genera are in any way equal, for data enabling us to estimate these interrelationships are in almost all instances lacking, and, in any event, they would be very difficult to decide, for it frequently happens that species which appear to resemble each other very greatly may really be less affiliated by bonds of true affinity than others which differ more conspicuously.

I would prefer therefore to divide a large family or subfamily like the Pleurotomidae, into more or less definitely limited and definable tribal groups, and to regard most of the subdivisions under these tribal headings as true genera until their values can be determined more accurately. This course would seem to be preferable for example in the recently published classification of the Pyramidellidae by Dall and Bartsch (Proc. Biol. Soc. Wash., XVII). The tribes in this case — Pyramidellini, Turbonillini, Odostomiini and Murchisonellini — are probably somewhat less differentiated than those of the Pleurotomidae, but there have been so many generic names published that this course would at least appear to be more convenient than that followed.

The eight tribes of Pleurotomidae indicated by material at present accessible to me may by defined or outlined by the following general characters: —

Animal bearing an operculum; shell usually many-whorled; outer lip generally thin at maturity 2
Animal non-operculate; shell generally smaller and with fewer whorls, frequently characterized by a greater development of plicae about the contour of the aperture and a thickened outer lip at maturity 7
2 — Anal sinus at least distinguishable and usually deep 3
Anal sinus obsolete 6
3 — Sinus more or less distant from the suture 4
Sinus adjacent to the suture 5
4 — Inner lip with little or no deposit of callus posteriorly; shell generally large and moderately thin in substance, the canal usually elongate, the ribbing frequently wanting ..... PLEUROTOMINI
Inner lip with thicker deposit of callus particularly evident posteriorly; shell smaller in size as a rule and thicker in substance, the canal usually much abbreviated; ribs never obsolete ..... CLAVINI
5 — Sinus deep and distinct; shell generally very thin and fragile in substance, inhabiting palaearctic waters exclusively and for the most part living ..... BELINI

Sinus broad, indefinitely limited anteriorly and feeble, sometimes barely traceable; shell usually thick in substance; genera entirely extinct and mostly Eocene ..... PSEUDOTOMINI

6 — Shell very small, slender, thick in substance and with short aperture, surface strongly sculptured, ribbed or cancellate..... DONOVANIINI

7 — Anal sinus small but well defined, usually deep and distinct, adjacent to or very near the suture; shell varying greatly in size and thickness of substance, mostly living, the genera and species numerous.... DAPHNELLINI

Anal sinus very broad and ill-defined, with its deepest part on the obtuse periphery near the middle of the whorls; shell minute in size and fragile in substance; species few in number; Eocene to present time.... TARANINI

Anal sinus obsolete; shell small in size, mitriform, with long narrow aperture, thick in substance; species few in number, recent in development..... MITROMORPHINI

These tribes are not all rigorously isolated or strongly delimited and there are several generic types before me which, from general appearance, may prove to be annectant or doubtfully referable to any of them, but they serve very well in a broad way and there is very seldom any doubt as to the proper reference of a species by its general facies alone. The genus *Tomella* may perhaps best serve as an illustration of these aberrant forms. This genus, while evidently bearing a phylogenetic relationship with *Perrona*, as shown by the embryo and nepionic whorls, differs so greatly in other characters that it not only cannot be regarded as at present closely allied to *Perrona*, but must be considered one of the most remarkable genera of the entire family. While evidently a member of the tribe Pleurotomini, it departs from its most significant characteristic in possessing a large deposit of callus at the posterior limit of the aperture, though, upon closer observation, it can be perceived that this callus in not quite homologous with the posterior tumid callus of the Clavini and is probably formed in a different way. The chief peculiarity of *Tomella* resides in the form and anterior position of the anal sinus, and in the fact that this sinus is wholly covered and concealed from view by the successive growth of the shell, so that it does not appear upon the spire whorls — a character which isolates it completely in the family.

In making use of the characters before referred to as legitimate criteria for the definition of genera, a large amount of comparative study and latitude of interpretation will be

necessary, and it may be remarked in passing that the general habitus of the shell is frequently a more important criterion than any one of them. For example, it may be correctly assumed that the characters of the embryo are of great weight in an estimation of genera, but I find the variations of this part of the shell must be used with very much more caution than might be supposed necessary, especially in the paucispiral and multispiral conditions, which are of themselves by no means uniformly indicative of generic difference. In some genera such as *Gemmula* Weink. (=*Hemipleurotoma* Coss.) having a rather complex embryo of some five or six whorls, the lower one to three of which are finely costulate, there is a remarkable persistence and stability of form and no perceptible change in type, either in the embryo or general characteristics of the shell, from the earliest Eocene to the present time, and the wholly extinct *Microdrillia* Csy., having a similar embryo, is also constant during the much shorter geological period spanning its history, while in others the normally multispiral embryo may frequently become paucispiral, sometimes as a result of progressive degradation, but in several instances in consequence of varied environment alone.

Of this inconstant type of embryo I have in mind three striking illustrations. The first is afforded by the genus *Eopleurotoma*, of Cossmann, where the embryo is paucispiral and obtuse in normal European species and multispiral and more acute in others. The American representatives such as *sayi*, *haeninghausi*, *nodocarinata* and many more, have a multispiral, closely coiled and rather acute embryo of at least four whorls, although evidently typical *Eopleurotoma* otherwise and so regarded by Cossmann himself; the latter author, however, does not allude to the radical variations of the embryo. The second instance is that of *Pleurofusia* De Greg., the type of which is the American Oligocene *servata* of Conrad, containing many species having the embryo typically multispiral, conical, pointed and closely coiled, but in such forms as *collaris* and *hilgardi* Csy., of the Jacksonian Eocene and *declivis* Con., of the Vicksburg Oligocene, the embryo becomes obtuse and paucispiral, in the last named

species indeed so notably obtuse as to appear swollen owing to the very large nucleus or posterior tip of the embryo — following the terminology of Cossmann. It appears unwarrantable to separate these paucispiral forms from the others, as in general habitus, type of sculpture and all other features they seem to be perfectly congeneric. The third genus, which was founded by De Gregorio upon the American Oligocene *cochleáris* Con. and named *Pleuroliria*, has a multispiral embryo with ribbed lower whorls in its earlier geological stages, but a very small and obtuse paucispiral protoconch, with larger nucleus and almost entirely obsolete riblets, in its later history, the general characters of the shell remaining constant throughout to such an extent that the living form has recently been declared identical with the Oligocene type; — to a superficial view they are indeed completely identical, but the embryos are strikingly different. These examples are mentioned to indicate in some measure the great difficulties and uncertainties that will attend the rigorous definition of genera in the Pleurotomidae — difficulties which are accentuated among the multitude of small non-operculate forms, which, being comparatively modern in development, have the intermediate gradations not yet so thoroughly eliminated as is the case with the almost equally numerous but geologically much older operculate series.

While I feel certain that the number of true genera of Pleurotomidae is much greater than usually admitted, the above discussion may serve to indicate some of the obstacles which will be encountered in the conscientious study of them, obstacles which will not be removed until we understand more thoroughly than now the meaning of all the modifications of structure and sculpture displayed so lavishly among these wonderful and fascinating objects. These modifications of sculpture, form and coloration all mean something, and are caused by varying conditions of adaptation to environment in its broadest sense.

In the subsequent discussion of the tribal groups outlined above, I have included a few genera which seem worthy of

special study, either because of their relative importance or in order to correct certain errors which have appeared in print.

Pleurotomini.

This tribe is the most extensive of the operculate series and comprises the largest and most conspicuous species of the family. Excepting certain aberrant forms such as *Antiplanes* and *Genota*, the latter of which was considered a Conid by Cossmann, though probably more correctly a Pleurotomid, the genera arrange themselves naturally about the types known as *Pleurotoma*, *Surcula* and *Clavatula*, the first being distinguished by the entire absence of longitudinal ribbing and corresponding prominence of the spiral sculpture, the second having well developed ribs as a rule and inconspicuous spirals, and the third — a special type — distinguished in general by a spiniform modification of the ribbing. These three type forms diverged from a common descent stem in very remote time, the third being the most modern offshoot and peculiarly developed in the middle and upper European Tertiaries and in the living fauna of West Africa. In addition to these, there are certain peculiar fossil types which did not survive the world-wide revolution at the close of the Oligocene, among which may be mentioned *Scobinella* with related genera, distinguished by absence of true ribs, strong spirals frequently interrupted by arrested growth giving a characteristic tessellated sculpture and usually having strongly developed plicae on the columella, a character extremely rare or perhaps entirely wanting among the living forms of the tribe.

Pleurotoma Lamk.

This genus is composed of large and rather slender species, with a high and many whorled spire which is generally somewhat twisted apically, long and more or less contorted though untwisted canal and a deep parallel-sided anal sinus, which is not situated on the peripheral carina, but formed on a flat depressed spiral band just behind the periphery. The sculpture consists of broad close-set and obtuse spiral carinae, the

surface polished and the lines of growth not distinct. The embryo is small, obtuse, smooth and paucispiral, consisting of about a single whorl. *Pleurotoma* is represented by a moderate number of species confined to the Indo-Pacific region, such as *babylonia* Linn., *crispa* Lamk., *grandis* Gray and *garnonsi* of Reeve, and is a recent development, not occurring, as far as known to me, in the fossil state. It probably exists, however, in the unexplored upper Tertiaries of those regions.

Lophiotoma n. gen.

Although having the small smooth embryo of a single whorl, polished surface and obsolete lines of growth, characterizing *Pleurotoma*, this genus may be recognized at once by the relatively shorter and stouter form as a rule, less elongate and straighter beak, which is strongly tapering in certain large forms like *unedo*, finer, more acutely elevated and less close-set spiral carinae, with a usually distinct and even, finely lineolate concavity from the peripheral carina to the suture or subsutural collar, the latter being generally present and by the deep anal sinus formed centrally on, and not behind, the peripheral carina, the latter being more strongly elevated and usually subduplex. The genus is exclusively recent, composed of large species inhabiting the Indo-Pacific region and is represented in my cabinet by *tigrina*, *virgo* and *marmorata* Lamk., *unedo* Val., *jickeli* Weink., *leucotropis* A. et R. and the following: —

General form and ornamentation similar to *tigrina* but more slender, the dark brown spots very minute and sparse, but similarly distributed, the duplex peripheral carina more strongly elevated and the anal sinus deeper and narrower. Length of a specimen having 12 body whorls, 59 mm.; width, 13 mm. Cebu, Philippine Islands.....**microsticta** n. sp

Pleuroliria De Greg.

This genus, originating in the middle Eocene and coming down to the present time, is the American homologue of *Lophiotoma*, but is composed of much smaller species having a slender form, very characteristic sculpture of two to three strong spiral carinae, the peripheral bearing the small anal

sinus, and a conspicuous system of lines of growth, bioblique toward the peripheral carina and composed of excavated lines, which are less evident in the very early forms and most conspicuous in the modern species. The type is *P. cochlearis* Con. of the Vicksburg Oligocene. *Pleuroliria* comprises two groups, which, although strongly resembling each other in general form and type of sculpture, are in reality almost subgeneric in value as shown below: —

Group 1. — *Embryo multispiral and acute.*

Lines of growth less pronounced, uneven and never deeply incised; species small in size and older geologically 2

Lines of growth deeply incised and conspicuous 3

2 — Shell rather slender, each of the spire whorls with a moderate subsutured carina, the surface immediately below it being concave and rather rapidly expanding to a stronger peripheral carina perfectly smooth and uniform, and situated at some distance above the middle, the surface thence cyclindric or very feebly descending to the suture below and having two slightly smaller and somewhat approximate carinae at the middle, the lower margin also carinulate. The two carinae below the periphery become more widely separated on the larger whorls, subequally trisecting the space between it and the lower margin, and, on the body whorl, continue thus unaltered to the base of the shell. The concave surface above the periphery has a fine spiral thread above the middle. Embryo moderately stout, conical, closely coiled, rather higher than wide, with five whorls, the four upper smooth, broadly, evenly convex and polished, the lowermost with longitudinal riblets; beak moderately long, the aperture proportioned nearly as in *cochlearis*. Length of a specimen having 5 body whorls, 9 mm.; width, 2.7 mm. Lower Claiborne Eocene of St. Maurice, La. ..... **simplex** n. sp.

Shell nearly as in the preceding but with the embryo shorter and stouter, fully as wide as high and not evenly conical but becoming substyliform toward the very acute tip, of five whorls, the lowermost covered with riblets. Spire whorls shorter; carinae below the periphery more equal and close-set, the peripheral carina finely, obtusely crenulate. Length of a specimen of 2 body whorls, 3.4 mm.; width, 1.2 mm. Lower Claiborne Eocene of St. Maurice ..... **crenulosa** n. sp.

3 — Embryo of four whorls, evenly conical, short, fully as wide as high, the upper three whorls smooth polished and broadly convex, the lowermost bearing acute but rather widely spaced longitudinal riblets. Shell rather short and stout, with slender beak, the spire whorls very short, each with two strong thick and equal carinae, one just below the suture, the other near basal third; between the latter and the basal margin there is a fine spiral thread first appearing on about the third whorl; lines of growth only moderately distinct and somewhat irregular. Length of a specimen having 3 body whorls, 4.5 mm.; width 1.7 mm. Jacksonian Eocene of Montgomery, La. ..... **jacksonella** n. sp.

Embryo of nearly five whorls, much higher than wide, more rapidly acuminate toward tip, the upper two or three small whorls smooth, the lower two with rather close-set and more or less oblique longitudinal riblets; species much larger, with relatively less abbreviated whorls and very distinct incised lines of growth, the peripheral carina only slightly below the middle of the spire whorls..... 4

4 — The prominent subsutural carina separated from the still stronger peripheral carina by a concave space having several fine spiral threads, this surface being subequal to or only slightly shorter than the interval separating the subsutural carina from the peripheral carina of the whorl above; embryo large and conspicuous, the riblets strong. Length of a specimen having 8 body whorls, 19 mm.; width, 6 mm. Vicksburg Oligocene (upper and lower). (= *supramirifica* and *tizis* De Greg.) **cochlearis** Con.

The strong and rather more acutely elevated subsutural carina separated from the coarser peripheral carina by a relatively much shorter concave space, which is always very much shorter than the interval between the subsutural carina and the peripheral keel of the whorl above; sculpture otherwise nearly similar, the embryo narrower and with more feebly elevated riblets; shell smaller in size and of slightly more slender form. Length of a specimen having 6 body whorls, 8.5 mm.; width, 2.7 mm. Red Bluff Eocene..... **subsimilis** n. sp.

Group II. — *Embryo small, obtuse and paucispiral.*

Embryo of nearly two whorls, very broad and obtuse at tip, the lower part gradually acquiring some feeble and irregular longitudinal riblets; shell moderately stout, attaining rather large size and thicker in substance, the lines of growth being conspicuously excavated; spiral whorls each with a strong subsutural and a still stronger and thicker submedian spiral carina, the concavity between them gradually acquiring one or two fine spiral threads and the space below the submedian a fine raised line which on the larger whorls gradually becomes a carina equal in size to the subsutural. Length of a specimen of about 9 body whorls, 27 mm.; width, 7.5 mm. Lower Miocene of Alum Bluff, Fla. ..... **barretti** Guppy

Similar to the preceding, but much more slender in form and thinner in substance, the embryo still smaller but rather less obtuse, of scarcely more than a single whorl, the riblets not visible in specimens at hand. Length of a specimen of 11 body whorls, 23.5 mm.; width, 6 mm. Caloosahatchie Pliocene of Shell Creek, Fla..... **albida** Perry

I have not seen the types of *barretti* and *albida*, but assume that the West Florida Miocene species, described above, is identical with the former, as it appears to pertain to the same geological horizon, and adopt Dr. Dall's identification for *albida*. The latter author has recently (Trans. Wag. Inst., Vol. 3, p. 28) confused these two species with the widely different *cochlearis* of Conrad.

The European Miocene *Rouaultia* Bell., seems to share some of the characters of both *Pleuroliria* and *Gemmula*, but has the peripheral carina greatly expanded and crenulate, giving it the general appearance of *Cochlespira*, with which it was confounded by Cossmann. It however differs completely in the form and position of the anal sinus, *Rouaultia* having the sinus on the expanded peripheral carina, as in the two genera mentioned, while in *Cochlespira* it is situated on the concave fasciolar surface between the periphery and suture.

Gemmula Weink.

According to the definition given by Cossmann (Essais de Pal. Comp., 2 Livr., 1896, p. 62) there would seem to be no reason to doubt that *P. denticula*, the type of *Hemipleurotoma* Coss., belongs to the same group of species as the living *kieneri* Doum., *monilifera* Pease, and several others, in fact the latter is so similar to the American Eocene and Oligocene *amica* and *rotaedens*, that, following the views of some authors, it might be considered a mere variety. Although I have not seen *gemmata*, the type of *Gemmula*, it is assumed to be entirely congeneric with *kieneri*, *fusca*, *gilchristi* and *monilifera*, which are before me, these four species representing the most typical form of *Gemmula* in retaining the denticulations of the peripheral carina throughout the growth of the shell. The living *albina* Lamk. and *deshayesi* Desm. are somewhat aberrant in having the denticulation of the peripheral carina confined to the very young or nepionic whorls and gradually becoming lost on the larger whorls, as in the American fossil *alternata*, of Conrad, and some other species. The genus will prove to be very extensive, retaining all essential characteristics of form and sculpture from the very early Eocene to the present time, and there will probably prove to be at least 30 species in our Eocene strata alone. The species of *Gemmula* vary in size from relatively small to distinctly above the average of the tribe, and resemble *Pleurotoma* in being devoid of true ribbing or visible lines of growth, in general form, and in the development of spiral carinae, but differ in having

the peripheral carina flattened, duplex to complex, and bearing more or less conspicuous nodules, in having the deep parallel-sided anal sinus borne centrally on the peripheral carina, as in *Lophiotoma*, and in having a large closely coiled multispiral conically or ogivally pointed embryo, with two or three smooth apical, and one to three longitudinally ribbed basal, whorls. The canal is moderately long, and straight, or nearly so. The American fossil species known to me may be identified by the following characters: —

Costuliform denticulations of the more strongly elevated peripheral carina, short, varying in length from scarcely a fourth to a sixth or seventh part of the entire length of the whorls..... 2

Costulations longer, the peripheral band much broader and generally less strongly elevated, about a third as wide as the length of the whorls, the costules usually becoming gradually less distinct on the larger whorls..... 15

2 — Denticulations remaining equally well developed and conspicuous throughout the life of the shell or virtually so..... 3

Denticulations only distinct on the young body whorls, becoming gradually more ill defined and obsolete or subobsolete on the larger whorls; species rather larger in size..... 12

3 — Denticulations in the form of small longitudinal costules from one of the two peripheral carinae to the other, crossing the intervening feeble depression with but partial interruption..... 4

Denticulations feeble, in the form of compressed nodes of the individual peripheral carinae and much broader in a spiral direction than long.. 11

4 — Fasciolar surface below the subsutural carina deeply concave, then rapidly expanding to the strongly elevated peripheral carinae..... 5

Fasciolar surface below the subsutural carinule very feebly concave, but obliquely and only moderately rapidly expanding to the less elevated peripheral carinae..... 7

5 — Form stout, the apex of the beak distinctly reflexed; subsutural concavity with only about two fine revolving threads which are situated at the middle of the concavity; embryo rather large and well developed, higher than wide, with two or three very small smooth whorls at the summit, followed by three larger whorls which are conspicuously costulose, the riblets of the lowest whorl coarser and generally more widely spaced than the others. Red Bluff Eocene.....**amica** Csy.

Form slender, the beak not reflexed at apex; concave surface below the subsutural carina with a greater number of fine spiral threads, about three on the largest whorl of *genitiva*, numerous in *rotaedens;* embryo smaller but almost similarly formed and sculptured..... 6

6 — Peripheral double carina at the middle of the whorls, the denticulations rather fine; form very slender, the aperture and canal combined about a third of the total length. Upper Vicksburg Oligocene...**rotaedens** Con.

Peripheral double carina distinctly below the middle of the whorls, broader, the denticulation coarser and more close-set; form not quite so slender though about equal in length to *rotaedens;* aperture and canal combined more than a third of the total length. Length of a specimen having 6 body whorls, 11.5 mm.; width, 3.4 mm. Lower Claiborne Eocene of Lee Co., Texas.....**genitiva** n. sp.

7 — Whorls with two rather widely separated carinae below the suture; embryo relatively small in size, somewhat higher than wide, with about three small smooth apical whorls, gradually increasing as usual, and two whorls covered with coarse and rather widely spaced riblets; peripheral duplex carina not strongly elevated, the space between it and the lower and larger of the subsutural carinae about twice as wide as the peripheral band and having two spiral threads and sometimes three other smaller ones in addition; space below the periphery with several spiral carinules; shell rather large, the beak straight but somewhat feebly, obliquely swollen toward tip; length of the aperture and canal together nearly two-fifths the length of the shell. Length of a specimen having 9 body whorls, 27 mm.; width, 7.3 mm. Lower Claiborne Eocene of Smithsville, Texas.....**margaritosa** n. sp.

Whorls with a single subsutural carina; species very small in size.....8

8 — Embryo large, much higher than wide and elaborately sculptured.....9

Embryo smaller, about as high as wide, with three smooth rapidly increasing apical whorls and two basal covered with the usual riblets.....10

9 — Embryo forming a regular sharply pointed cone, much higher than wide, the upper three or four whorls smooth, the lower two with riblets, those of the basal whorls coarser, those of the one immediately above it very feeble; space between the peripheral carinae and the subsutural usually with a single spiral thread. Length of a specimen having 4 body whorls, 9.5 mm; width, 3.2 mm. Jacksonian Eocene of the Red River Kimbrel bed.....**conjuncta** n. sp.

Embryo forming a regular sharply pointed cone, much higher than wide, the upper three whorls smooth, very small and together higher than wide, the three lower having a beautifully regular system of strong close-set equal ribbing, occupying the entire embryo except the very small smooth 3-coiled tip; feebly concave surface above the periphery generally having several close-set spiral threads. Length of a specimen having 4 body whorls, 8.9 mm.; width, 2.8 mm. Lower Claiborne Eocene of St. Maurice, La., and also of Lee Co., Texas [Aldrich].....**nucleata** n. sp.

Embryo large, much higher than wide, the lower three whorls subcylindrical and covered with fine arcuate and rather widely spaced riblets, the upper smooth part consisting of two or three whorls very rapidly diminishing in size and together much wider than high; moderately concave surface above the duplex peripheral carina usually having two close-set threads. Length of a specimen having 3½ body whorls, 7.7 mm.; width, 2.8 m.m. Upper Claiborne ferruginous sands, Ala. (= *acutirostris* Con.).....**childreni** Lea

10 — Denticulation of the duplex peripheral carina unusually small and widely spaced, the concave surface, between the periphery and subsutural carinule usually with two fine spiral threads; beak nearly straight, very slender, the aperture and canal combined but little less

than half the length of the shell. Length of a specimen having 4 body whorls, 7 mm.; width, 2.7 mm. Lower Claiborne Eocene of St. Maurice, La.....**parvidens** n. sp.

11 — Spire elongate, gradually and evenly acuminate, about twice as long as the aperture and canal combined; beak gradually acuminate and straight from the abrupt contraction below the convexity of the body whorl; embryo of the *Gemmula* type, well developed, of two or three small smooth whorls followed by about three covered with arcuate riblets; spire whorls each with a strong subtumid subsutural collar which is fully as large and prominent as the obtusely crenulate and obscurely double, generally narrow and feebly elevated peripheral carina, the latter distinctly below the middle; space below this carina with a single spiral carinule; space above it to the subsutural collar, broadly, evenly and rather feebly concave, with numerous very fine spiral threads; peripheral crenulations of the body whorl apparently rather less distinct; they become constantly longer in a spiral sense from one whorl to the next below. Length of a specimen having 6 body whorls, 14 mm.; width, 3.9 mm. Lower Claiborne Eocene of Lisbon, Ala.....**lancea** n. sp.

12 — Crenulate periphery at, or only slightly below, the middle.....13

Crenulate periphery at, or extremely near, the lower or anterior margin of the spire whorls.....14

13 — Crenulations of the periphery fine, apparently not more than a seventh or eighth as long as the whorl, becoming obsolete on the seventh or eighth body whorl; subsutural collar apparently present on the crenulate younger whorls; embryo imperfect in the types. Length of a specimen of about 10 body whorls, 48 mm. Claiborne (ferruginous sand).....**alternata** Con.

Crenulations coarse, becoming on the sixth body whorl large, low, tumescent rounded elevations, with no distinct principal carinae, the entire surface having rather close-set and equal fine spiral carinules; on the upper whorl the crenulations are more abruptly formed and are crossed by about three rather coarser lines, but the periphery nowhere has the abruptly elevated form seen in *rotaedens* and allies; the periphery is distinctly below the middle of the whorl and not at the middle as it seems to be in *alternata*, and the crenulations are nearly a fourth as long as the whorl, about 18 in number; upper whorls with a distinct subsutural collar which disappears completely on the larger whorls; body whorl below the posterior end of the aperture having rather coarse lines separated by about three smaller close-set threads. Length of a specimen having 6 body whorls about 19 mm.; width, 5.6 mm. Lower Claiborne Eocene of St. Maurice, La.....**obsolescens** n. sp.

14 — Shell moderately stout, the spire gradually, evenly acuminate and but little longer than the aperture and canal combined; embryo much higher than wide, with numerous riblets as usual; spire whorls evenly sculptured throughout with coarser and single finer intermediate spiral lines, not interrupted in longitudinal succession by the obtusely and gradually elevated periphery which bears obtuse crenulations, the latter disappearing altogether on about the seventh whorl; surface broadly, feebly concave from the subbasal periphery to the suture above, the latter having no trace of subsutural collar even on the nepionic whorls.

Length of a specimen of 8 body whorls, 32 mm.; width, 8.5 mm. Lower Claiborne Eocene, St. Maurice, La. ..... **ludoviciana** Vgn.

15 — Costules of the peripheral raised band carried obliquely across the surface between the latter and the subsutural cariniform collar, generally forming a distinct beading on the latter; spiral lines above the posterior end of the aperture very sparse and indistinctly defined, below the latter on the body whorl having the form of coarse conspicuous and widely spaced lyrae, the concave intervals between the lyrae having many close-set striae. Length of a specimen having 6 body whorls, 16.5 mm.; width, 4.9 mm. Upper Vicksburg Oligocene..... **tenella** Con.

Costules not extending across the rather more deeply concave surface above the somewhat narrower and more strongly elevated peripheral band, the subsutural carina finer and almost even, not at all beaded, the concave surface with three or four close-set and distinctly defined spiral lines; body whorl below the periphery with coarse and widely spaced lyrae; shell similar in form to *tenella* but a little smaller. Red Bluff Eocene..... **ancilla** Csy.

Costules abruptly confined to the peripheral band as in *ancilla*, the subsutural collar very large, obtusely elevated and coarsely beaded, separated from the peripheral costulose band by a deep abrupt concavity about equal in width to the raised band and bearing a fine and almost even median thread; space below the band with about two close-set and rather fine spirals which are more or less nodulose; shell differing from the two preceding in its smaller size, shorter and much stouter form and thicker substance, the embryo small and more rapidly pointed. Length of a specimen of 5 body whorls, 9.5 mm.; width, 3.6 mm. Jacksonian Eocene of Moody's Branch, Miss..... **nodulina** n. sp.

Lancea is a rather aberrant species in general features of sculpture but seems to belong to the present genus; it is represented by a single rather water-worn specimen. The characters of *alternata* are taken from a very careful drawing from the original type kindly lent me by Mr. Aldrich; Conrad states that *lesueuri*, of Lea, is identical, but the latter is a widely different species, having the anal sinus on the upper concave surface of the whorls. A number of species, not alluded to above, are known, but not being able to study the types or any accurate drawings, I am unable to include them at present; among these are *Pl. mediavia* and *equiseta*, of Harris, and *moniliata* of Heilprin.

It is desirable before discussing the genera of the *Surcula* type to draw attention to a succession of peculiar Indo-Pacific forms, resembling *Pleurotoma* in the absence of true ribbing and great development of the spiral carinae, but differing in

the very obtuse base of the shell, absence of canal and in the very small anal sinus situated well behind the peripheral carina; one of these genera may be named as follows: —

Tomopleura n. gen.

In this genus the form is rather slender and elongate, with acute many-whorled spire and a small smooth and generally paucispiral embryo; the aperture is usually about a third as long as the shell. The whorls have each two larger and more conspicuous smooth spiral carinae, one just below the suture, the other at about the middle and also a few other smaller carinae. A moderately concave fasciolar surface, bearing the small but deep anal sinus, is situated between the two principal carinae. Lines of growth generally coarsely incised and very conspicuous, as in *Pleuroliria*. The species are moderate or small in size and rather numerous, those before me being labeled *P. nivea* Phil., the type of the genus, *pouloensis* Jouss., *makimonos* Jouss. and *violacea* Hinds. Such species as *cincta* Lamk. and *bijubata* Reeve, resemble typical *Tomopleura* in general form and sculpture and particularly in the obtuse base, absence of beak and form and posterior position of the anal sinus, but the absence of distinct lines of growth, generally acute and substyliform apex and some other characters would seem to indicate that they are at least subgenerically different.

Among the generic types which may be considered in many respects intermediate between the more typical Pleurotomids which precede and the allies of *Surcula* to be mentioned below, may be cited *Scobinella* Con. (= *Moniliopsis* Con., and *Zelia* De Greg.), *Eucheilodon* Gabb, *Glyptotoma* n. gen., *Sinistrella* Meyer, *Trypanotoma* Coss., *Clinura* Bell., *Cochlespira* Con. (= *Ancistrosyrinx* and *Candelabrum* Dall), *Cochlespiropsis* n. gen., *Protosurcula* n. gen., *Eosurcula* n. gen., *Cochlespirella* Csy., *Microdrilla* Csy., *Aforia* Dall, *Antiplanes* Dall, *Bathytoma* H. and B., and *Megasurcula* n. gen. These genera are all devoid of true ribbing, as in the preceding typical Pleurotomids, but have the spirals less developed. The great

majority of them have the anal sinus situated on a posterior declivous or concave fasciolar surface as in *Surcula* and related genera, but, in some instances, as the very isolated *Glyptotoma*, the sinus is medial and formed on a prominent periphery. This peculiar group of genera is entirely and long since extinct, except *Cochlespira*, which appears to have a history almost as extended as *Gemmula* from the Eocene to the present time, and *Aforia*, *Antiplanes* and *Megasurcula*, which as far as known are exclusively living. It is the only group containing reversed or sinistral shells, a character which seems to be of generic value, as I have never seen a dextral specimen of *Sinistrella americana* Ald., among a very large number examined, although otherwise *Sinistrella* is rather closely allied to *Trypanotoma*, a very distinct genus founded by Cossmann upon the *Pleurotoma terebriformis* of Meyer. It is also the only group in which the plications of the columella become in any way a conspicuous feature, although this character does occur in some of the Surculid genera in a less developed degree; it is greatly developed in *Eucheilodon*, *Scobinella* and *Glyptotoma*. In *Clinura* and *Cochlespira* the whorls are broadly expanded into a thin spiral plate usually reflexed and crenulate at the edge. In *Aforia circinata* Dall, this expansion is reduced to a small but abruptly formed median ring.

Eucheilodon Gabb.

This genus is abundantly distinct from *Scobinella* in having the anal sinus formed upon an elevated and prominent peripheral shoulder well above the middle of the whorls, and not in a concave posterior fasciolar area; it also differs materially in the embryo, which, although of the same general multispiral type, is very much larger, and in the form of the outer lip, which does not have the broadly lobed and advanced form of *Scobinella*, in its very narrow linear aperture with more strongly lyrate outer lip and in possessing a columella fold near the posterior end of the inner lip, which is never present in *Scobinella*. The system of columella folds is more elaborate than in that genus and the spiral lyrae are

usually not nodulated by the lines of interrupted growth, which are more apt to appear only between them, so that the peculiar tessellated sculpture of *Scobinella* is wanting or much less developed. There are apparently three known species which may be identified by the following characters: —

Shoulder angle of the whorls obtusely rounded and situated far above the middle; spiral lyrae coarse and close-set..... 2
Shoulder angle broadly angulate in profile and situated only just visibly above the middle; spiral lyrae finer and unequally spaced..... 3
2 — Shell stouter, the lyrae very coarse and somewhat dissected by the lines of interrupted growth, especially on and above the shoulder, giving a granular effect; shoulder angle more prominent and bicarinate. Jacksonian Eocene.....**crenocarinatum** Heilp.
Shell much smaller and more slender, the spiral lyrae not quite so coarse, flat and very clearly defined throughout, not at all dissected by the lines of growth which are only visible in the depressed intervals; shoulder angle evenly rounded. Lower Claiborne Eocene of Texas (= *laeviplicatum* Gabb).....**reticulatum** Gabb
3 — Surface of the spire whorls evenly declivous from the finely unicarinate periphery posteriorly to the fine subsutural carina, and, anteriorly to the suture, the posterior declivous surface with a fine thread near the peripheral carina and another one-third the distance from this thread to the subsutural carina, the anterior declivous surface with two fine carinae one-fourth and three-fifths the distance from the peripheral carina to the suture; body whorl below the posterior end of the aperture becoming abruptly closely lyrate; columellar folds numerous but very fine and feeble, the posterior isolated fold small though abruptly denticuliform. Length of a specimen having between 2 and 3 body whorls, 10 mm. Lower Claiborne Eocene of Texas...**gabbianum** n. sp.

The type of *gabbianum* is a unique specimen in the cabinet of Mr. T. H. Aldrich. There are apparently two species in the Jacksonian Eocene confused under the name *crenocarinatum*, but I am not prepared to define them at present.

Glyptotoma n. gen.

Some peculiar small species generally of robust form, having a narrow tumid columella ridge, which is stongly bi- or triplicate and the anal sinus median in position and formed upon a broad double nodose spiral, require separation as a distinct genus for which I would propose the above name. The general type of tessellated ornamentation is strikingly

similar to that characterizing *Scobinella*, and the aperture, canal and embryo are of corresponding form, but the anal sinus is wholly different in form and position and the outer lip is not advanced and arcuately lobed. They have occurred thus far only in the Lower Claiborne Eocene of Texas, and those before me may be readily recognized as follows: —

Broadly rhomboidal in outline, the spire evenly conical, the aperture and very short canal combined constituting nearly half the entire length; lyrae of the body whorl below the periphery very coarse and widely spaced, alternating with single fine raised lines; columellar folds two or three in number. Length of a specimen of 5 body whorls, 11.5 mm.; width, 4 mm..... **crassiplicata** Gabb

Narrower, the spire subventricose or narrowing more rapidly toward the apex; aperture very much less than half the entire length..... 2

2 — Larger species, with a nodulose subsutural spiral and a similar but broader duplex peripheral spiral, the two separated by a concave surface which is rather longer than the subsutural collar, and having a fine nodulose thread at its middle; another similar fine thread is very close to the lower margin of the large peripheral spiral, and, below this on the body whorl, the lyrae are equal, granose and moderately widely spaced, the lines of growth fine, deep and close-set, appearing between the lyrae but independent of the nodules; columellar folds about three in number. Length of a specimen of 5 body whorls, 9 mm.; width, 2.8 mm..... **conradiana** Ald.

Smaller species, with numerous very close-set spirals of coarse nodules, the subsutural gradually splitting into two finer spirals on the larger whorls, the concave space below the collar short and with fine irregular thread or threads; spirals below the peripheral alternating in size to the aperture, then equal and almost in mutual contact to the base of the shell; nodules in longitudinal lines from one lyra to the next, giving a closely costulate appearance which does not exist in the preceding species; columella with two large rounded and very approximate folds at the middle, the lower more oblique than the upper; embryo of about four whorls, higher than wide; aperture and canal relatively longer than in *conradiana*. Length of a specimen of 3 body whorls, 3.9 mm.; width, 1.75 mm..... **parvula** n. sp.

These species are all well represented in the cabinet of Mr. Aldrich, to whom I am indebted for the material at hand.

Trypanotoma Coss.

A very distinct genus, apparently confined to the middle Eocene faunas of the southern United States and characterized by the comparatively small size and slender form of the

species and by the elongate spire, very short and rather oblique aperture, broad shallow sinus formed upon a double submedian and more or less nodulose peripheral elevation and very short, broadly obtuse paucispiral embryo. The three species represented by material in my cabinet may be distinguished among themselves as follows:—

Nodules of the peripheral carinae smaller, not coalescent longitudinally; aperture one-third as long as the shell or nearly so..... 2

Nodules of the peripheral carinae coarser, each being fused with its opposite, forming large longitudinal nodules; spire relatively more elongate, the aperture about a fourth as long as the shell..... 3

2 — Spiral carinules relatively coarser, generally two in number between the central double peripheral carina and the lower margin; lower of the two subsutural carinae nodulose; lines of growth very coarse, cancellating the body whorl below the convexity. Length of a specimen of 5 body whorls, 7 mm.; width, 2.6 mm. Upper Claiborne ferruginous sand..... **terebriformis** Meyer

Spiral carinules fine; spire whorls shorter and more transverse, the second carinule below the suture simple and not nodulose; but one raised line between the periphery and lower margin and another forming the latter; space between the nodulose peripheral carinae and subsutural carinules much longer, being twice as long as the width of the peripheral band; lines of growth distinct and uneven but feebler than in *terebriformis*. Length of a specimen of about 7 body whorls, 10 mm.; width, 3 mm. Lower Claiborne Eocene of St. Maurice, La.. **obtusa** n. sp.

3 — Form very slender; subsutural carinae simple, very coarse and nearly contiguous; peripheral carinae coarse, separated from the subsutural by a concave space which is subequal in length to the width of the peripheral duplex band and having two fine but strongly elevated and very approximate spiral threads; space below the peripheral nodulose band but little longer than the width of the latter and having one coarse carinule and another forming the lower margin; lines of growth strong and uneven on the body whorl below the convexity. Length of a specimen of 9 body whorls, 10.6 mm.; width, 2.8 mm. Lower Claiborne Eocene of Moseley's Ferry, Burleson Co., Texas..... **longispira** n. sp.

In *terebriformis* the spiral depression below the subsutural carinae is only about as long as the width of the duplex peripheral band, while in *obtusa* it is fully twice as long as the latter, giving these two species a distinctly different facies. *Longispira* is widely different, and, besides the characters noted in the table, has a still shorter, more obtuse and scarcely at all reflexed beak, which is sometimes umbilicate along the callus of the inner lip; it was collected in consid-

erable number by Mr. T. H. Aldrich, to whose generosity I owe the examples before me.

Cochlespiropsis n. gen.

This genus is allied to *Cochlespira* but differs greatly in having the beak obliquely elevated near the tip, the periphery of the whorls simply angulate in profile and not lamellarly expanded, reflexed or crenulate and the sculpture extremely minute and feeble, close-set and even, wholly differing in character from that prevailing in *Cochlespira*. The genus seems to have become extinct by the middle of the Eocene, not occurring above the Lower Claiborne, and, in fact, limited as far as known to that epoch. The two species before me may be distinguished as follows: —

Spire above the periphery of the body whorl evenly and rather rapidly acuminate, shorter than the portion below that periphery; sculpture of the body whorl below the periphery consisting of moderately close-set and distinct spiral threads which are somewhat uneven in size. Length of a specimen of 7 body whorls, 20 mm.; width, 6.5 mm. Lower Claiborne Eocene of Wheelock, Texas..... **engonata** Con.

Spire above the periphery more elongate, nearly equaling in length the portion below, very gradually acuminate and more rapidly and arcuately so toward apex; ornamentation of the body whorl below the periphery consisting of extremely minute, closely crowded and equal spiral threads which are frequently somewhat wavy or subinterrupted by uneven irregularities of growth. Length of a specimen of 8 body whorls, 31 mm.; width, 8.8 mm. Lower Claiborne Eocene of Lisbon, Ala..... **blanda** n. sp.

There is no vestige of a tumid or carinulate collar below the suture in this genus.

Cochlespira Con.

The periphery is lamelliform to a greater or less degree in this genus, the edge always crenulate and bent backward, and there is usually a well-marked and finely beaded collar below the suture which, however, sometimes becomes obsolete on the larger whorls. The posterior broad fasciolar surface has some fine spirals near the periphery but is usually completely devoid of sculpture elsewhere, except the arcuate lines of

growth formed by the large anal sinus. Below the periphery the sculpture consists of coarse and close-set beaded lines, the one marking the posterior limit of the aperture larger and more conspicuous than the others. The beak is slender, without trace of the external oblique ridge of *Cochlespiropsis*, the columella straight or broadly and feebly arcuate and the aperture and canal combined are generally as long as the remainder of the shell or nearly so. The type is *C. cristata* Con., of the Vicksburg Oligocene, and the other species known to me as forming typical members of the genus are *bella* Con. and *columbaria* Ald., of the American Eocene, and *terebralis* Lamk., of the European Eocene. I have not seen the living species, *elegans* and *radiata*, of Dall, upon which he founded *Ancistrosyrinx*, and my previous statement as to the identity of the latter genus with *Cochlespira* rests upon the published opinion of Cossmann. If true, *Cochlespira*, *Pleuroliria*, *Gemmula* and *Orthosurcula* would be the only Eocene genera known to me as surviving to the present time. It is probable that the species described by Harris under the name *Drillia dipta*, will constitute the type of a distinct genus near *Cochlespira*. The various minute species of *Cochlespirella* Csy. (Proc. Acad. Nat. Sci., Phila., 1903, p. 279) are left for future consideration.

Protosurcula n. gen.

In this genus and *Eosurcula* there is no trace of ribbing, and the moderately large species composing them may be considered allied more closely to the *Cochlespira* group than any other; the embryo in both is conical or conoidal and multispiral, and, in *Protosurcula* is generally very large and with conspicuous longitudinal riblets on the lower whorls. The collar below the suture is cariniform and the long fasciolar surface between it and the obtuse periphery is broadly concave and with fine spiral lines; below the periphery the spiral lyrae are rather coarse. The columella is straight and generally simple, though sometimes having a strong plica above the middle. The spire tapers evenly to the apex and the beak is slender and frequently very long, the aperture and long straight canal combined being much longer than the

remainder of the shell in *gabbi*, which is assumed as the type. The species before me may be distinguished by the following characters: —

Columella straight and unmodified; embryo very large..... 2
Columella with a stout plica at about the middle of the aperture proper; embryo much smaller, though of the same general type..... 3
2 — Embryo stout; subsutural collar flat, composed of two, and, subsequently, about three, coarser spiral carinules; concavity below the subsutural collar, long, concave; periphery anterior in position, rounded in profile, moderately swollen, with the spiral lines larger. Lower Claiborne of Wheelock, Texas.....**gabbi** Con.
Embryo large but much narrower, the lower whorls similarly, though more coarsely, costulate, the upper smooth whorls forming a much more acutely elevated apex; subsutural surface broadly, feebly swollen and covered with numerous fine but strong carinules merging gradually into the small threads of the subjacent concavity; remaining characters nearly as in *gabbi*, the beak more rapidly tapering, very slender at tip, the aperture and canal together but little longer than the remainder of the shell. Length of a specimen of 5 body whorls, 23.5 mm.; width, 6.8 mm. Lower Claiborne Eocene of Smithville, Texas — Mr. Aldrich.....**tenuirostris** n. sp.
3 — Form nearly as in the two preceding, the embryo very much smaller in size, conical, with the lower whorls ribbed; subsequent whorls each with a strongly and abruptly elevated double carina at basal third, the two carinae becoming more widely separated and with an intermediate thread on the larger whorls; space between the double carina and the subsutural cariniform collar broadly concave and with strong and widely spaced spiral threads; double carina of the first two body whorls crenulate. Lower Claiborne Eocene of Wheelock, Texas — [*Borsonia*].....**plenta** H. & A.

The last of these species may possibly be subgenerically different from the others but certainly cannot be further removed. The species figured by Harris as the young of *plenta* is probably specifically different.

Eosurcula n. gen.

The embryo in *Eosurcula* is much narrower than in *Protosurcula*, strongly elevated and smooth throughout, the subsutural collar smaller and less developed, the fasciolar surface thence obliquely ascending but straight in profile or nearly so to the obtusely angulate periphery, on and below which the spirals become coarser. The aperture and canal are nearly as

in *Protosurcula*, but the peculiar narrow elevated embryo, perfectly smooth throughout and without riblets, higher shoulder angle and oblique fasciolar surface, less developed subsutural collar and some other differential characters, will readily serve to separate the two genera, which are perhaps the most characteristic and abundant forms of the Lower Claiborne Eocene,— and impart a marked difference in habitus. The species are more numerous than those of the preceding genus, those known to me being outlined as follows:—

Peripheral carina crenulate, at least on the small upper body whorls, situated at the middle and subduplex..... 2

Peripheral carina devoid of any trace of crenulation at any point..... 5

2 — Larger species, the peripheral carina at or above the middle of the whorls, crenulate on the small or nepionic whorls only..... 3

Small species, the periphery more obtusely angulate, more feebly carinate and distinctly below the middle of the whorls; all the whorls apparently crenulate on the periphery..... 4

3 — Peripheral carina at the middle of the whorls, apparently duplex, coarse but only moderately elavated; between it and the base there is another similar double carina; slightly above it, at the lower part of the oblique fasciolar surface, there is a fine spiral carina; declivous space thence to the fine subsutural collar with two or three very fine spiral threads. Texas, Caldwell Co.....**moorei** Gabb

Peripheral carina well above the middle of the whorls; between it and the base there are two carinae, which are apparently smaller than the peripheral and less elevated. Lignitic Eocene of Wood's Bluff, Ala.....**tuomeyi** Ald.

4 — Moderately stout, the subsutural collar small; surface thence regularly ascending to the crenulate periphery and having two or three coarse but feeble spiral lines; surface below the periphery on the spire whorls with two rather coarse and widely spaced carinules in low relief; below these on the body whorl the surface is closely, evenly lyrate. Upper Claiborne ferruginous sand [*Conus*].....**pulcherrima** Heilp.

5 — Peripheral carina double, its upper carinule smaller and less prominent than the lower, the latter a little below the middle; subsutural carina unusually strong, at some distance below the suture, the surface thence to the upper peripheral carina regularly oblique, with a single carinule at lower two-fifths; on the larger whorls a few other very minute and inconspicuous threads can be observed; surface below the lower peripheral carina, with two carinae, the uppermost interval thus formed much the larger, both with an intermediate central and feeble thread; lyrae on the body whorl moderately coarse, well separated and only occasionally with intermediate threads. Length of a specimen of 6 body whorls, 22 mm.; width, 6 mm. Lower Claiborne Eocene of Lisbon, Ala.....**concinna** n. sp.

Peripheral carina single, narrow but strongly elevated, at the middle; subsutural carina, fine; surface thence to the periphery regularly oblique

and covered with rather close-set, fine but sharply elevated threads, the one nearest the peripheral carina much the largest; surface below the peripheral carina cylindric, with a similar carina a little below its middle and another near the lower edge; space between the peripheral carina and the one next below with a finer carina a little below its middle. Length of a fragment consisting of the embryo and 4 spire whorls, 5.6 mm.; width, 3 mm. Lower Claiborne Eocene of St. Maurice, La..... **helicoidea** n. sp.

Mr. Aldrich mentions no crenulation on the periphery of the nepionic whorls of *tuomeyi*, but these are said to exist by Prof. Harris.

Bathytoma Harr. et Burr.

Dolichotoma Bell. (nom. praeocc.).

According to Cossmann, this genus exists fossilized in all the Tertiary strata and is also found living, but I am inclined to believe that that author has confused a number of generic or subgeneric types and that the really typical *Bathytoma* occurs only in the upper European Tertiaries, where it is represented by *Murex cataphractus* Broc. The geologically much older American species, from the upper Eocene of Red Bluff and the Vicksburg Oligocene, described by Conrad under the name *Pleurotoma congesta*, is a much smaller species and differs in some respects, perhaps subgenerically, but may be considered a *Bathytoma* for the present. The peripheral ridge is much better marked than in *Megasurcula* and is frequently costulose and the obtuse oblique columellar ridge, very feeble in *Megasurcula* is conspicuous in at least the American *Bathytoma congesta*. This ridge is not homologous with the columellar plicae of some other genera, which are doubtless to be closely associated in any natural arrangement, such as *Scobinella*, and, occurring much lower down on the columella, is probably different in origin and significance.

Megasurcula n. gen.

The embryo in this genus is apparently paucispiral, but conoidal, the canal obsolete, the base of the shell broadly obtuse, the pillar with an oblique ridge externally; sinus large and

broadly rounded, very near the suture, the fasciolar surface below the suture broad and feebly concave, the periphery obtuse and not very prominent, and the suture simple, without subjacent elevated collar. The surface is rendered somewhat rough by relatively fine, close-set and irregular spiral lines, and there is no longitudinal sculpture except lines of growth. The species are large and ponderous, and include *Surcula carpenteriana* and *tryoni* of Gabb, from the coast of California. *Megasurcula* is a widely isolated and strongly characterized genus, belonging exclusively to the living fauna of the Pacific coast of North America as far as known at present. It is, at the same time, a rather direct descendant of the extinct *Bathytoma*, but the species are of far larger size, *carpenteriana* being probably the largest or most ponderous Pleurotomid known. The embryo, which is conoidal and multispiral in *Bathytoma*, has gradually lost some of its whorls, as shown in *Megasurcula*, which of itself would not be a generic character, but there is in *Bathytoma* a broad constriction of the body whorl below the convexity, forming a short stout beak, which is wholly unobservable in *Megasurcula*, and the aperture is much more capacious in the latter, with the anal sinus much larger and different in form and position.

Asthenotoma Harr. et Burr.

Oligotoma Bell. (nom. praeocc.).

This genus, entirely represented by extinct species of slender form and elevated, evenly and gradually acuminate spire, conspicuous development of the spiral lyrae and short aperture, should evidently be considered with the preceding genera and especially with *Trypanotoma* and allies, but it is somewhat of an annectant form, as the American species at least have true ribbing on the nepionic whorls which becomes completely lost on the larger volutions of the shell. It is therefore one of those puzzling exceptions which render an arrangement of the genera in a dichotomous table so difficult and unsatisfactory. The embryo in the type, *Pl. basteroti* Desm., of the European Miocene, is said by Cossmann

to be paucispiral, but the drawing shows a multispiral protoconch; this is, however, a matter of minor importance. The anal sinus is broad, sometimes very feeble and always median in position on the spire whorls though not identified with any particular one or more of the subequal and rather coarse flat spirals. The beak has no external oblique tumidity. There can be but little doubt, in view of geographical variations and wide distribution of this genus, that *Endiatoma*, of Cossmann, should be regarded as a synonym or as constituting a slightly differentiated section of *Asthenotoma*. The American species known to me may be recognized as follows, the characters of *texana* and *shaleri* being taken from accurate drawings and descriptions. They are all peculiar to the Lower Claiborne Eocene: —

Concavity below the subsutural carina large, extending very nearly to the middle of the whorl, the surface thence to the lower margin having three to four equal and widely spaced spiral lines; spire almost twice as long as the aperture and canal combined. Length of a specimen of 9 body whorls, 18 mm. Texas.....**texana** Gabb

Concavity below the subsutural carina very short..... 2

2 — The concavity much longer than the intervals separating the four or five spiral lyrae below it; spire rather rapidly acuminate, apparently not more than one-half longer than the aperture and canal together; form unusually stout; columella straight. Type defective but probably representing a specimen of about 8 body whorls, having a length of 14 mm. Louisiana.....**shaleri** Vgn.

The concavity not longer than the intervals separating the large lyrae below the middle of the whorls.....3

3 — Form somewhat as in the preceding species, the spire rapidly tapering and not more than one-half longer than the aperture and canal combined, the inner outline of the columella broadly, evenly arcuate; spire whorls with a strong flattened subsutural lyra, bordered beneath by a feeble concavity not longer than a seventh or eighth of the total length of the whorl, succeeded by two smaller and more approximate carinules and these by four strong lyrae occupying the entire space thence to the lower margin; on the larger whorls there is a single small raised line alternating with the last-named lyrae. The obtuse ribs of the nepionic whorls are few in number and become completely obsolete on the fourth or fifth whorl. Length of a specimen of 7 body whorls, 12 mm.; width, 3.4 mm. Texas (6 miles south of Wheelock) — Mr. T. H. Aldrich.....**eximia** n. sp.

Form very much elongated, the spire apparently more than twice as long as the aperture and canal combined, gradually, evenly acuminate; columella somewhat obliquely tumid; spire whorls each with a very coarse

subsutural lyra, two others similar to the subsutural and moderately approximate at the middle and another similar lyra between the lowermost of the median and the lyra forming the lower margin; spiral space below the subsutural lyra exactly equal to the space between the lowermost of the median lyrae and the one next below the latter. Length of a specimen of about 9 body whorls, 15.5 mm.; width, 3.9 mm. Lisbon bed, Alabama — Mr. Aldrich.....**strigosa** n. sp.

Strigosa is represented before me by a single specimen in rather imperfect condition, but it is a very distinct species readily recognizable by the characters of the table. The spire whorls are more inflated in *eximia* than in either *strigosa* or *texana*, being arcuate in profile; the sides in those species are nearly straight.

Hemisurcula n. gen.

In this genus the shell is fusiform, with the embryo conoidal, multispiral and closely coiled, the nepionic spire whorls alone costate and having also an elevated collar below the suture. The more recent whorls become devoid of lyrae or costae, though having throughout densely close-set and subequal microscopic striae, except the body whorl abruptly below the posterior end of the aperture, which is obliquely and rather coarsely lyrate. The canal is moderate, straight, and, together with the aperture, forms about half the length of the shell. The sinus is broadly rounded and median in position on the spire whorls, the columella simple. The type of this genus is *Pl. silicata*, of Aldrich, a very remarkable and isolated species occurring in the Lignitic Eocene of the Gregg's Landing beds of Alabama. The beaded subsutural collar, subjacent depression and swollen and finely ribbed lower parts of the two whorls immediately below the embryo are lost completely on the larger whorls, though the subsutural collar can be feebly traced as a slightly tumid line gradually descending further below the suture with the growth of the shell. Besides *silicata*, the genus will include the much stouter *Pl. roscoei* Harris, from the same horizon.

Orthosurcula n. gen.

Before proceeding to define some of the more typical allies of *Surcula*, it will be of advantage to refer to a generic type as named above, combining some of the features of the preceding group and the true Surculids. The species are large, moderately stout, completely devoid of ribbing and have the beak elongate, tapering, relatively slender and straight. The spirals are close-set, moderate or small in size, sometimes granulose, and the whorls are more or less broadly inflated below and feebly concave posteriorly. The outer lip projects in the middle as a broad rounded lobe beyond the juxta-sutural part, with the sinus large and posterior, as in *Surcula*, and the embryo is paucispiral. The types are the upper Eocene *Pl. longiforma* Ald., of Red Bluff, Miss., and the European Eocene *Surcula transversaria* Lamk. These species have much finer sculpture than the living *Surcula australis* Lamk., which is also an *Orthosurcula*.

Surcula H. et A. Adams.

Turricula Schum. (nom. praeocc.).

This genus is composed of a moderate number of more or less large species, stout in form, with the beak somewhat elongate and the columella distinctly twisted, the beak generally having a distinct oblique external ridge which is wholly wanting in *Orthosurcula*. The surface has numerous short oblique costae, confined throughout to the peripheral ridge, and, in a few species such as *tornata* only visible on the nepionic whorls, becoming lost on the larger whorls — like the peripheral denticulation of some forms of *Gemmula*. The embryo is small and paucispiral. The median parts of the outer lip project beyond the juxta-sutural part in a broad rounded lobe and the sinus is large, rounded and posterior, in these respects resembling *Bathytoma* and *Megasurcula*. The type is *S. javana* Linn. (=*nodifera* Lamk.), from the coast of China, and the genus will include as well *tuberculata* Gray, *tornata*

Dillw. (=*javana* Kiener non Linn.) and *fulminata* Kiener, from the Indo-Pacific fauna, and the South African *Clavatula gravis* of Hinds. *Surcula*, as far as known to me, is a modern development and most of the very numerous old Tertiary forms will constitute other genera.

Pleurofusia De Greg.

This name was given by De Gregorio to a species which he described and figured under the name *longirostropsis*, stating that it may be a variety of *servata* Con., and indicating the latter species as one of the generic types. Nothing very similar is known to me from the Upper Claiborne ferruginous sand, but there is a specimen in the cabinet of Mr. Aldrich, from the Lower Claiborne, which greatly resembles the figure referred to. At any rate, it seems evident that *Pleurofusia*, as represented by *servata* and the specimen alluded to, must be recognized as valid. The species are moderate to rather small in size and of somewhat slender form, with rather slender, somewhat elongate beak and strong, longitudinally and transversely rounded, almost entire costae, generally some seven or eight in number. The embryo is conoidal and multispiral to obtuse and paucispiral in form, but never has any conspicuous longitudinal riblets. The fasciolar surface is usually well defined, in great part obliterating the ribs below the suture, but in some cases is less evident, the ribs being strong thoughout the length of the whorl. The species chiefly characterize the upper Eocene and Vicksburg Oligocene of the Southern States, but would seem to have originated in such forms as *langdoni* Ald., of the lower Eocene, which has more numerous ribs, and extend upward at least to the lower Miocene of West Florida, where the genus is represented by a species resembling *servata*. The other species known to me are *declivis* Con. and *oblivia*, *vicksburgensis*, *evanescens*, *collaris* and *hilgardi* Csy., with several others still undescribed. Such species as *servatoidea* Ald., will form an allied genus somewhat resembling *Pleurofusia* in the ribbing but differing in the position of the anal sinus and character of the sculpture.

Tropisurcula n. gen.

The shell in this genus is small in size, of slender form, with moderately elongate and slender beak and narrow, closely coiled, multispiral embryo, which is higher than wide, and perfectly smooth and polished throughout. The ribs are about equal in number to those of *Pleurofusia* but culminate in transverse prominences at the summit of an angulate median periphery, and sometimes become gradually feebler on the larger whorls. The spiral lines are subequal among themselves, relatively rather coarse but low, and very close-set throughout. The species known to me are two in number as distinguished by the following characters: —

Ribs nine to ten in number, rounded and distinct throughout the length of the whorls, though much more prominent on the peripheral ridge and tending to become extinct on the broad fasciolar surface of the larger whorls; spiral lines coarse but not much elevated, even above, coarser and usually separated by a fine line below, the periphery; apex of the embryo obtuse. Length of a specimen of 5 body whorls, 10 mm.; width, 2.9 mm. Red Bluff Eocene to the Vicksburg Oligocene.....**caseyi** Ald.

Ribs seven or eight in number, more broadly rounded, very prominent on the angulate periphery, becoming rapidly obsolete below, and usually wholly effaced on the fasciolar surface above, the periphery, especially on the larger whorls; spirals rather wide but feebly elevated, close-set and subequal throughout, but still feebler on the fasciolar surface; embryo acute at tip, of five smooth and highly polished whorls, narrowing more rapidly above the two basal whorls, the apical very small. Length of a specimen of 4 body whorls, 7.5 mm.; width, 2.5 mm. Lower Claiborne Eocene of St. Maurice, La.....**crenula** n. sp.

The embryo in *caseyi* is much more evenly and feebly tapering from base to apex than in *crenula*. The former species was described by Mr. Aldrich under the generic name *Drillia*.

Surculoma n. gen.

The type of this genus was regarded by Cossmann as a member of his genus *Amblyacrum*, and, while the small paucispiral embryo is very nearly the same in general form, all the other characters differ to so great a degree that it is not easy

to comprehend the motives for this association. In *Surculoma* the beak is rather slender and somewhat abruptly formed below the convexity of the body whorl, the ribs large and few in number, the spire whorls always more or less angulate in profile at the periphery and the sculpture invariably consists of minute and very close-set spiral lines. In *Amblyacrum*, however, the beak is thick and gradually formed, the ribs numerous and close-set, the spire whorls almost evenly arcuate in profile and the spiral sculpture coarse and not close-set. The general facies of the shell in the two genera is wholly different. There are four species of *Surculoma* known to me at present, described under the names *tabulata* Con. (=*coelata* Lea)—assumed as the generic type—from the Upper Claiborne sand and *penrosei* and *dumblei*, of Harris, and *stantoni* Vaughan, from the Lower Claiborne of Texas and Louisiana. *Penrosei* Harr., which was published by its author as a variety of *huppertzi*, is in no way closely related to that species, having a radically different embryo as well as a different position of the anal sinus. *Dumblei* is more slender and has a relatively higher spire and shorter aperture than the others, but does not differ otherwise. *Subaequalis*, of Conrad, may possibly be an aberrant species of this genus, although the periphery is decidedly more obtuse; it seems to have the same peculiar minute close-set spiral lines, which, in all the species, alternate with larger lines toward base; it is very stout in form, with short obtuse rounded ribs, the aperture and short slender canal together being fully as long as the remainder of the shell if not longer. The embryo is wanting in the type and apparently only known specimen, which is from the Upper Claiborne sand. A very large and conspicuous umbilicus occurs in *tabulata* as an abnormal character.

Microsurcula n. gen.

This genus is composed of a considerable number of species, all of which are very small, with the body whorls seldom exceeding four in number at maturity. The embryo is relatively large and complex, conical, multispiral, closely coiled and with about five whorls, the lower one to three of which are

covered with fine acute longitudinal riblets. The periphery is more or less obtusely swollen, the ribs small and numerous and reduced in size and reversed in curvature on the broad fasciolar surface, generally attaining the suture or small subsutural collar above. The canal is rather tapering in form, straight, moderate in length, and, together with the aperture, about half as long as the shell. Of the two following species the first is to be regarded as the type: —

Shell very small, with two or three body whorls, moderately stout, the embryo of five whorls which gradually and evenly increase in size, the apical whorl or nucleus very minute, acutely rounded and relatively higher in form, the second to fifth broadly convex and closely covered with an elaborate system of fine riblets, becoming more widely spaced on the fifth and gradually merging without break into the ribs of the subsequent whorls; these ribs are some twelve in number, elevated, rounded, extending throughout the convexity of the body whorl below and to the very fine subsutural collar above, becoming reduced and arcuately reversed in curvature across the fasciolar surface; spiral lines moderately coarse, even and flat, rather widely spaced and without intermediate lines, becoming close-set near the base and slightly smaller and more close-set on the fasciolar surface. Length of a specimen of 2 body whorls, 4.8 mm.; width, 1.5 mm. Lower Claiborne Eocene of St. Maurice, La..... **nucleola** n. sp.

Shell slightly larger and rather more slender, with more elevated and less obtusely rounded periphery, the aperture and canal combined noticeably shorter than the remainder; embryo relatively larger, higher than wide, of about five whorls, the four uppermost smooth, forming a large even cone, the two lower whorls of which are relatively more inflated toward base, the fourth acquiring coarse feeble riblets which grow stronger on the fifth, where they are broadly arcuate and widely spaced; the fifth whorl is large, and more evenly convex and gradually acquires spiral sculpture but no defined peripheral swelling; subsequent whorls with about eighteen small but distinct ribs, gradually becoming obsolete at the lower margin, attenuated and arcuate in reverse on the fasciolar surface but not quite attaining the rather distinct cariniform subsutural collar; on the second body whorl the ribs form acute nodules on the peripheral ridge but do not extend materially below the latter, and, while still distinct on the fasciolar surface, come still further from attaining the subsutural collar; spiral lyrae on and below the periphery moderately coarse, even, well spaced and without intermediate threads, becoming close-set on the beak; on the fasciolar surface they are finer and close-set. Length of a specimen of 2 body whorls, 6.4 mm.; width, 2.0 mm. Lower Claiborne Eocene (from a well seven miles south of Jewett, Texas) — Mr. T. H. Aldrich..... **bellula** n. sp.

This genus will also include *P. georgei* Harr., from the Lignitic Eocene of Wood's Bluff, Ala., and an undescribed

species, figured by Prof. Harris on the same plate as the young of *P. servatoidea* Ald., with which it evidently has no relationship. This latter species seems in fact to be exceedingly close to *georgei*, and appears to be from the same horizon. *Microsurcula* will include, in addition, the Upper Claiborne *Fusus vetustus*, of Lea, and two species from the Vicksburg Oligocene, one of which I recently described under the name *P. intacta*.

Lyrosurcula n. gen.

The species of this genus bear some resemblance to those of *Pleurofusia*, but the spire whorls and ribbing are more cylindrical and the spiral lyrae are different in character, being equal and equally spaced among themselves below the fasciolar surface and not enlarged on the ribs to any very noticeable degree. They differ also in the embryo, which, although conical and multispiral, has the lower whorl or two covered with longitudinal riblets, these being absent in *Pleurofusia*. The three species at present before me may be recognized by the following characters: —

Embryo acutely conical, higher than wide, of 6 whorls, the apical or nucleus more swollen and slightly eccentric, the first three smooth, the lower three covered with very regular riblets which at first are very fine, close-set and feeble, becoming gradually coarser and more widely spaced, the sixth whorl gradually acquiring the spiral lyrae, these appearing distinctly between the riblets; fasciolar surface beginning abruptly at the end of the sixth whorl; next two whorls — the first two body whorls — having strongly rounded outline, about eleven feebly elevated and transversely rounded subcylindric ribs, three strong but narrow, well separated spiral lines in rather more than basal half and a decliv-ous, broadly concave fasciolar surface, with distinct arcuate lines of growth and two fine spiral threads and not entirely crossed by the rapidly obsolete ribs; subsutural collar very small and feebly carinulate; canal short, slender and twisted. Length of a specimen having a complete embryo and 2 body whorls, 4.3 mm.; width, 1.6 mm. Lower Claiborne Eocene of St. Maurice, La..... **elegans** n. sp.

Embryo less acute at tip, a little higher than wide, of four whorls, the upper three smooth, the fourth alone with a few widely separated, obliquely arcuate and rather feeble riblets, body whorls nearly as in the preceding, with ten broadly rounded ribs distinct in the inflated subcylindric lower half of the whorls and scarcely intruding at all upon the steeply descending and broadly concave fasciolar surface; the sculpture

throughout is very nearly as in *elegans* but with larger and stronger ribs. Length of the embryo and first three spire whorls, 2.7 mm.; width, 1.5 mm. Lower Claiborne Eocene of St. Maurice, La.....**acuta** n. sp.

Embryo larger and much stouter than in *acuta*, fully as wide as high, acutely pointed, the nucleal tip being small and rather elevated, the whorls four in number, closely coiled, feebly convex, all highly polished and devoid of sculpture, the lowermost only acquiring a few riblets in its last quadrant, which riblets merge gradually into the ten or eleven ribs of the body whorls; lyrae and fasciolar surface nearly as in the two preceding species. Length of a specimen consisting of the embryo and one complete body whorl, 1.9 mm.; width, 1.0 mm. Lower Claiborne Eocene of St. Maurice, La.....**obsoleta** n. sp.

The species described by Harris under the names *vaughani* and *sylvaerupis* also belong to this genus, but, besides differing from those of the table to some extent in the form of the embryo, have the ribs less numerous and relatively larger; the Upper Claiborne *baumonti* may likewise be included as a slightly aberrant or degenerate member. A considerable number of specimens of *elegans* were obtained, but none with more than two body whorls, and it is probable that it may really be a small species when mature; in this case it would contrast greatly with *vaughani* and *sylvaerupis*, which are moderately large species with a many-whorled spire.

Leptosurcula n. gen.

In this genus the form is very slender, fusiform, the canal very long, the aperture and canal together being about half as long as the entire shell. The embryo is relatively very large, higher than wide, conical and composed of five or six polished whorls, the lower whorls gradually acquiring close-set longitudinal riblets, and then, equally gradually, the spiral lyrae. The type is the very isolated *P. beadata* * Harris, of the Texas

* The name "*beadata*" is of an etymology difficult to ascertain. If it is derived from the English word *bead*, referring to the beaded subsutural collar, it is indeed a "barbarism," or, at any rate, a procedure in the formation of specific names which is generally condemned. It is, however, perhaps not so much worse than *mortoniopsis* and *texanopsis* — Latin and Greek hybrids which have been used by two of our authors,— or such words as *texacona*, *texagyra*, *texacola* and *texalta*, which have been employed by Prof. Harris.

Eocene, a slender and much elongated species, with a long slender and gradually tapering beak. The series of small rounded close-set nodules, forming the subsutural collar, are completely independent of the relatively large and oblique costae, which are less than half as numerous. The strong even spiral lyrae are also a peculiar feature.

Among other described genera of the tribe Pleurotomini, special mention should be made of *Eopleurotoma* Coss., very rich in species in the European Eocene and in the American Lower and Upper Claiborne, where it is represented by such species as *nupera* Con. (=*rugosa* Lea and *protapa* De Greg.), *gemmata* Con. (=*tupis* De Greg.), *haeninghausi* Lea, *sayi* Lea (=*monilifera* Lea), *desnoyersi* Lea (=*lintea* Con. and *properugosa* De Greg.) and *nodocarinata* Gabb. In Europe *Borsonia* and *Epalxis* are well known fossil genera, but *Cordiera* would seem to belong rather to the Pseudotomini, as far as disclosed by published descriptions and figures, and is apparently not closely allied to *Borsonia*. The American *Borsonia plenta* belongs to *Protosurcula*, as stated before, and is not related to the true *Borsonia*, which is exclusively European.

There are some other distinct genera among our fossil species which are not further dwelt upon at present, principally because of lack of material. Among these types of more or less isolated genera may be mentioned *Drillia prosseri* Harr. and *Pleurotoma plutonica* Csy., which are congeneric, and the following apparently unique types: *carlottae*, *cainei* and *texanopsis*, of Harris, *exiloides* Ald., *nasuta* Whitf. and *lesueuri* Lea.

Clavini.

This tribe is less extensive than the Pleurotomini, but is nevertheless composed of numerous generic groups, which are less isolated among themselves than those of the foregoing tribe, a condition due in a great measure to the fact — as before stated of the non-operculate series, — that the Clavini are largely modern in development and include comparatively few extinct types. Many Eocene fossils assigned to that most

astonishing complex known as *Drillia*, do not belong even to the present tribe and are true Pleurotomids. The genus *Drillia* is in reality very limited, and, as far as known to me, includes only its West African type species described by Gray under the name *umbilicata*. The Clavini may be considered to possess three principal types of structure or general facies represented by *Clavus*, *Crassispira* and *Drillia*, but the definition of genera in these sections will prove to be an uncertain and rather unsatisfactory matter. The genus *Cymatosyrinx* Dall, is a rather isolated fossil type, and is truly represented only by *lunata* Lea, and a few other species of our upper Tertiaries, having a peculiarly short, broad and obtuse paucispiral embryo and an external oblique rostral ridge. Many of the species placed with the type, even by its author, do not belong there. Cossmann assumes the name *Cymatosyrinx* for the old and very extensive genus *Clavus*, on the ground of preoccupation, because of the older name *Clava* Gm., but this is evidently inadmissible, *Clavus* being abundantly distinct from *Clava*, and if such generic words as these were not held to be distinct, very great confusion in zoological nomenclature would result. The species figured by Tryon in his "Structural and Systematic Conchology" as a typical *Drillia*, the *gibbosa* of Kiener, does not even belong to that section of the tribe, but should form the type of a genus closely allied to the true *Crassispira* as represented by the West Indian *bottae* Val. and the West African *callosa* Val. and *carbonaria* Rve. Although the shells in this tribe are generally thick and heavy, it is remarkable that some of the largest and heaviest of them, such as the three species of *Crassispira* just mentioned, are seldom or never found perfect when mature, but are invariably largely and roughly decollated. The following genus seems worthy of definition at the present time, as it is quite isolated and one of the oldest known types of the Clavini.

Eodrillia n. gen.

The typical forms of this genus are characterized by a smooth, or at most finely and spirally striate surface, well developed, more or less rounded ribs, which do not cross the

concave fasciolar surface below the usually well-developed subsutural collar and frequently tending to disappear on the larger whorls, a very short aperture, short, angulate base with nearly obsolete canal, open anal sinus of the usual form in *Clavus* and a conical pointed smooth multispiral and closely coiled embryo. Among the typical species may be mentioned *depygis* Con. (=*laevis* Con. and *pinaculina* and *solitariuscula* De Greg.), with its varieties *lonsdali* Lea and *surculopsis* and *fita* De Greg., of the Upper Claiborne ferruginous sand and *texana* Con. (=*texacona* Harr.), of the Lower Claiborne of Texas. It is possible that such forms as *tantula* Con., of the Vicksburg Oligocene, may also be included, although in that species there is no well-defined subsutural collar and the ribs attain the suture above. *Eboroides*, of Conrad, is more nearly a *Clavus* and cannot be included.

Belini.

The species of this small tribe are exclusively inhabitants of European arctic and subarctic waters, as far as definitely known to me at present. They are moderate or small in size and of thin fragile substance, frequently having a whitish coating which is difficult to remove in many cases, and, in others, such as *Typhlomangilia* and *Bela pyramidalis* Ström., bears the characteristic sculpture of the shell. The embryo varies in a most remarkable manner and serves to indicate, with other accompanying characters, some six or seven genera among the present representatives of *Bela*. Cossmann has referred several fossil forms to the genus *Bela* in its broad sense, but there is some doubt if any of them belong to the present tribe. The Australian Eocene "plesiotype" *Bela pulchra* Tate, certainly resembles some forms allied to *Clathurella* more than it does the Belini, especially in the conformation of the posterior parts of the aperture, but the large obtuse embryo would isolate it there, though scarcely more so than the American Eocene *Eoclathurella* to be described below. In any event *Bela pulchra* will form the type of a very distinct genus, probably assignable to the non-operculate series.

Pseudotomini.

This tribe, composed exclusively of extinct old Tertiary types, is confessedly somewhat artificial in scope. There is a certain general Fusoid habitus common to all, the shell being usually stout in form, with short or obsolete beak and the outer lip is broadly, feebly sinuate posteriorly to the suture, but without a clearly limited notch. *Pseudotoma* was placed among the Conidae by Cossmann and *Cordiera* in the Pleurotomidae. *Fusitoma sipho* Ald., was described by its author as *Fusus siphus* and *Varicobela smithi* Ald., was originally described under the name *Strombus smithi*, while other species, brought together to form the present tribe, were originally assigned to *Fusus*, *Mitra* and *Borsonia*, showing the doubt and uncertainty involving the relationships of the species. My conception of *Cordiera* is derived from the study of a small species from the "Calcaire grossière," labeled *Pl. nodularis* Desh., and, if it is a typical representative of that genus as maintained by Cossmann, there can be no doubt whatever of its very pronounced affinity with our *Mitra biconica*, of Whitfield, and *Borsonia ludoviciana* Vgn., which species may be considered as representing *Cordiera* for the present. As to the relationship between *Cordiera* and *Borsonia*, I am forced to assume that there is very little real affinity, but only a superficially apparent affiliation due to the plication of the columella, a character which is frequently sporadic and of little or no phylogenetic significance in the Pleurotomidae. Although the embryo of our Eocene *Pleurotoma heilprini* Ald., differs noticeably from that characterizing the European type of *Pseudotoma*, the remaining features of the shell agree very well, and we may conclude that *heilprini* represents the genus in the American Tertiary, but the species figured by Cossmann under the name *Pseudotoma bonellii*, is certainly generically different from *Ps. intorta* Broc., assumed as typical of *Pseudotoma*.

Ruscula n. gen.

The general form of the shell in this genus is short and stout, with a very short stout reflexed beak, rather abruptly

formed below the convexity of the body whorl, and a spiral sculpture of coarse subequal lyrae. The embryo is conoidal, compact and closely coiled, multispiral, or composed of about three whorls. The body whorls are evenly convex and coarsely ribbed, the subsutural collar not well defined. The columella is biplicate. The two species before me are both from the Upper Claiborne ferruginous sand, and may be defined as follows: —

Form very stout, the spiral lyrae coarser and more close-set, separated by scarcely their own width on the peripheral convexity, though widely separated below on the body whorl; columellar plicae moderately strong and extremely oblique. Length of a specimen of 5 body whorls, 17.5 mm.; width, 7.5 mm. [*Fusus*].....**plicata** Lea

Form less stout, smaller in size, the spiral lyrae finer, separated by about twice their width on the convexity of the body whorl, the central of the fine intermediate threads more pronounced than in *plicata;* columellar plicae very strong and much less oblique. Length of an equally well grown specimen of 5 body whorls, 13.5 mm.; width, 5.5 mm.....**extricata** n. sp.

Varicobela n. gen.

The shell here is of moderately large size, thick substance and very stout form, with strongly elevated rounded varices, usually about five in number on the first four body whorls. The embryo is large, broadly and regularly conoidal, much wider than high and composed of about three whorls. The body whorls are broadly and evenly convex, without pronounced peripheral prominence, having numerous long and rather narrow, elevated and obliquely sigmoid ribs and many fine lines of growth, which are cut by equally fine and regular spiral threads, producing a regular but very minute clathration; every fourth spiral thread is larger, these becoming strong and widely spaced lyrae on the body whorl below the convexity; aperture half as long as the shell, oblique, the canal very short but narrow and rather well differentiated. The inner lip is callous throughout and there are no columellar plicae. The type of this genus, rendered very isolated by the varices so unusual in the Pleurotomidae, is the *Strombus smithi*, of Aldrich, occurring in the upper Eocene strata at Red Bluff, Miss. A specimen of 4

body whorls measures 27 mm. in length and 12.5 mm. in width. The embryo is of the same general type as in *Pseudotoma*, as figured by Cossmann.

Fusitoma n. gen.

The type of this genus is *Fusitoma sipho*, a rather elongate, fusiform and moderately stout shell with somewhat thin walls, originally assigned to the genus *Fusus*. The aperture is feebly oblique and half as long as the shell, the canal very short and not differentiated from the aperture, of which it forms the gradually narrowed anterior end. The base is very gradually and sinuately narrowed below the broad convexity of the body whorl. The body whorls are broadly convex, becoming concave above near the suture, the latter feebly margined beneath. The ribs are obsolete, being replaced by long fine elevated lines apparently produced by arrested growth and crossed by somewhat conspicuous lyration. The embryo in my single example — which I owe to the kindness of Mr. Aldrich — is not in good condition, so that I cannot venture to describe it.

There have been some other species described and figured from the American Eocene, which may form genera in this tribe or enter some of those already defined and particularly *Fusitoma;* among these may be mentioned *Pl. leania* and *Pleurotomella sigma*, of Harris, *Pleurotoma capax* Whitf., *Fusus whitfieldi* Ald., and perhaps *Fusus harrisi*, of the latter author. I have not been able to study any of these species except by published drawings and descriptions.

Donovaniini.

The genus *Donovania* Bucq. (= *Lachesis* Risso; nom. praeocc.) is one of those doubtful forms which have been assigned widely different positions in the Gastropod series, and is included here as forming a distinct tribe of Pleurotomidae merely for the sake of completeness, and not because I have been able to make any investigations leading to personal con-

viction regarding its affinities. It is held to be a Pleurotomid by Tryon and Cossmann, but some other authors apparently consider it more closely affiliated with *Buccinum*. In *Donovania* the shell is very small in size, generally slender, with four or five body whorls which are evenly and feebly convex from suture to suture and without trace of fasciolar surface. The sculpture is strong and relatively very coarse, either simply clathrate or with rounded ribs, the coarse spiral lyrae mutually equal and some four in number. The aperture is short, from distinctly less to decidedly more than a third as long as the shell and is broadly oval. The canal is extremely short but rather well differentiated and the embryo is relatively large in size, hemispherical, smooth and paucispiral. It inhabits the present European seas.

It is stated by Cossmann that the genus *Nesaea*, of Risso, which, being preoccupied, was named *Chauvetia* by Monterosato, is synonymous with *Donovania* and that the *Folinaea*, of Monterosato, founded upon *Buccinum lefebvrei* Marav., is also synonymous, but, as Cossmann states — after Tryon — that *Donovania* in its broad sense occurs not only in the Mediterranean but in Japan, the East Indies and the Island of St. Paul, it is probable that there are a few really distinct genera confounded under that name, which lack of material and complete literature of the subject prevent me from investigating at present. *Donovania minima*, the type of the genus, according to Bellardi and Cossmann, occurs also in the Italian Pliocene and Post-pliocene strata, being described from the former under the name *Lachesis brunnea* Donov. The association of *Donovania* with *Bela*, which has been suggested, appears to me to be wholly unwarranted.

Daphnellini.

This enormous complex, one of the largest of the Gastropod series, is composed of moderately small to minute species, occupying diversified environments throughout the globe, but particularly abundant in the Indo-Pacific region and wonderfully developed near New Caledonia. In comparison with known living forms, the fossils are very few in number and

occur, for the most part, in middle and upper Tertiary strata. The numerous genera cluster about certain apparently isolated type forms such as *Clathurella*, *Glyphostoma*, *Cythara*, *Mangelia*, *Daphnella* and *Raphitoma*, which differ so greatly among themselves as to suggest the propriety of subtribal division, but after long and patient study of rather large material I have been unable to devise a system of characters to serve for the definition of these subtribal groups. *Cythara*, in its typical forms, is a rather heavy shell, sometimes reminding us of the Conidae, having a long oblique linear aperture and well developed labial plicae, but other forms occur in which the linear aperture shortens by degrees and becomes devoid of folds, giving us the conditions observed in *Mangelia*. Others, having a short but gradually more oval and pliciferous aperture, merge from *Mangelia* into *Glyphostoma* and these into *Clathurella*, which is a larger and more obese form with thinner shell substance, and *Clathurella* again into *Raphitoma* and *Bellardiella*, which usually have a thin non-plicate outer lip, and *Daphnella*, with very thin fragile shell walls and absence of the true ribbing so universal in the remainder of the tribe. The short or obsolete beak of *Daphnella* becomes elongate in *Teres* and still longer in *Pleurotomella*, and, in *Eucyclotoma* Boettg., we have, as frequently occurs, a remarkable special structure of the shell as well as an embryo differing radically from that of *Daphnella*, to which it is allied by the absence of true ribbing.

These various transitions are made through more or less small but abrupt differentials, indicating intermediate generic a subgeneric groups, but the genera are so numerous in proportion to the known species, that one may well hesitate to define them, although it should be stated that if these intermediate stages are not characterized as genera it will be impossible to set any definite limits to the principal genera named above. When fuller series of species shall have been collected throughout the world and scientific workers become more discriminating than at present, generic names will certainly have to be given a very large number of these remarkable type forms, but at the present time little or no use-

ful result could be attained by pursuing such a course. Monterosato has attempted it in a partial manner in the case of the Mediterranean Daphnellids, but his genera, which in my opinion will be proved ultimately valid, have been suppressed by Cossmann and others.

The name Daphnellini is here adopted for the tribal designation, though the name *Daphnella* is antedated by both *Cythara* and *Mangelia*, because both of the latter have been called in question. Cossmann rejects *Cythara* altogether in favor of *Eucithara* Fisch., and *Mangelia* is generally spelled "*Mangilia*" by recent authors. These courses are both erroneous, however, since there is no necessity for the substitution of *Eucithara* for the former, and the original spelling of the latter is *Mangelia*, which being the case, it is impossible to change it, in spite of the fact that the one intended to be honored in the name loses this honor by reason of the mistake.

The two genera described below are both widely isolated in the structure of the embryo and in other characters: —

Eoclathurella n. gen.

The shell in this genus is small in size, more or less elongate, having when mature about three convex body whorls, the aperture oblique and rather narrow, oval or sublinear, much less than half as long as the shell, the sinus relatively large, deep, semicircularly rounded, strongly everted and well separated from the suture, the posterior callous prominence well developed. The inner lip is callous throughout, bearing three or four short transverse plicae at maturity, the canal very short and generally not strongly differentiated. The ribs are numerous, elongated and extend in gradually reduced form to the suture above, the spiral lyrae rather small and widely separated, but abruptly formed and slightly enlarged on the ribs, the fasciolar surface convex, crossed by the ribbing but having finer and more close-set spirals. The embryo it relatively large, broadly conical, closely coiled and of between three and four whorls, the lowermost gradually acquiring some longitudinal riblets which merge gradually

into the ribs of the subsequent whorls. The two species in my cabinet may be readily identified as follows: —

Form slender; shell substance thinner; obtuse periphery of the whorls well above the middle and broadly rounded, scarcely differentiable from the general convexity; lyrae small in size, finer but scarcely more close-set above the periphery; ribs small, somewhat oblique, close-set and numerous, some eighteen in number; callus of inner lip distinct and with a fine free edge throughout; outer lip not distinctly modified within. Length, 4.5 mm.; width, 1.5 mm. Jacksonian Eocene of the Red River Kimbrel bed.....**jacksonica** n. sp.

Form stouter and with thicker walls, the periphery of the whorls at about the middle and broadly, faintly angulate in profile; lyrae rather strong and more noticeably dilated on the ribs, almost completely obsolete between the latter and much finer above the periphery; ribs much larger, rounded, longitudinal, about twelve in number; callus of the inner lip almost obliterated for a short distance below the strong prominence at the posterior part of the outer lip; inner surface of the latter prominent with obtuse callus near the sinus and also in a longitudinal subbasal ridge, and with one or two minute folds between the two large prominences. Length, 5.0 mm.; width, 1.8 mm. Jacksonian Eocene of the Montgomery bed, La.....**obesula** n. sp.

The species described by Meyer, from the Upper Claiborne sand of Alabama, under the name *Mangelia meridionalis*, undoubtedly belongs to this genus. It differs from the species above described in having two rounded and two carinated smooth embryonic whorls and five body whorls, and even with this number of whorls, which may be a mistake of the describer, the figured type seems to be immature, as the columellar folds do not appear and the outer lip is not of an adult type; it is materially larger than either of the species described in the table. This genus represents the oldest type of non-operculate Pleurotomidae known to me at present.

Helenella n. gen.

This generic name is proposed for certain very small species apparently confined to the fauna of St. Helena, though possibly extending to the entire West African faunal province and having a form of embryo wholly different from anything else in the tribe. The shell is oval or fusiform, moderately thick in substance, closely, spirally nodulose in

sculpture, having the aperture oblique, narrowly oval, nearly half as long as the shell and completely undifferentiated from the extremely short canal. The anal sinus is small but distinct and abruptly formed; it is but slightly everted from the axial line of the aperture, though separated from the suture by a thickened callus. The outer lip is not dilated and is non-plicate. Columella with about two broadly tumid oblique and approximate folds at the middle. The spire is half as long as the shell, with its outline even in profile from whorl to whorl, and without break due to individual convexity of the whorls, the side profile of each whorl very feebly arcuate, the sutural breaks in the curve of profile narrow; each whorl with about three very broad approximate spiral lyrae, forming moderately elevated tubercles or nodules on the numerous approximate ribs; pillar not differentiated, the base of the shell obconic. The embryo is smooth, of between one and two whorls, very broadly and obliquely obtuse at apex in profile, the summit concave, the nucleus extremely small. Body whorls three to four in number. The two species in my cabinet are the following:—

Shell white, variegated irregularly with dark brown; longitudinal ribs separated by much less than their own widths and very numerous, some twenty in number. Length, 4.0 mm.; width, 1.6 mm.
multigranosa Smith

Shell still smaller, clear and pale straw color throughout, the ribs separated by fully their own widths and about fifteen in number, much more nearly obliterated between the strong spirals than the latter are between the ribs. Length of a specimen of 3 body whorls, 2.9 mm.; width, 1.3 mm.
insolens n. sp.

The general outline of the shell in this genus is not unremindful of *Mitromorpha*, but it differs in having a distinct anal sinus. Probably many other species will be discovered, hitherto overlooked because of their minute size.

Taranini.

This tribe, though very limited in scope, is altogether isolated and differs from the preceding not only in facies, but in some important structural features, the most important

being the very broad shallow anal sinus situated on the periphery and not on or near the suture, which is its invariable position in the Daphnellini. The only genus at present known is *Taranis* Jeffr., a very minute and fragile shell, with the aperture broadly oval and the canal very short. The surface is clathrated by equal longitudinal and spiral raised lines and is without trace of true ribs. The body whorls are about three in number. No extinct species of *Taranis* is known from the European strata, but, singularly enough, a species which, from the figure, appears to be a true *Taranis*, was described by Prof. Harris from the middle Eocene strata of Smithville, Texas, under the name *finexa* (Proc. Ac. Nat. Sci., Phila., 1895, p. 64). This is one of the most interesting discoveries yet announced among our extinct Gastropods.

Mitromorphini.

The species of this tribe are very small, oval or fusiform in outline and generally strongly, spirally sculptured. The aperture is long and more or less narrowly oval, and, owing to the fact that the anal sinus is obsolete, some doubt exists as to their true relationship. In placing the tribe provisionally with the Pleurotomidae I merely follow the usual custom, having made no determinative studies myself. The species seem to be few in number and individually rare or, at least, but few exist in any collection accessible to me at present. The only representative in my cabinet has the apex of the shell worn away so that I am unable to describe the embryo, except in general terms as shown in the West Indian fossil forms described by Dr. Dall, in which it appears to be small, rounded or obtuse and paucispiral.

Species of *Mitromorpha* have been described from Japan, California, the Pliocene strata of Florida and the European Pliocene, the latter, the *subulata* of Cossmann, apparently being a typical member of the genus; so its distribution, though limited to the northern temperate regions as far as known, is, or has been, very extended. The columella is sometimes bi- or triplicate at the middle, and the outer lip is,

at least occasionally, finely plicate within throughout its length. The species described by Dr. Dall from the Florida Pliocene under the name *pygmaea*, will probably form a genus or subgenus different from the purely lyrate species including *cincta* Dall from the same beds, as well as *lirata* Ad., assumed as the type of *Mitromorpha*. This genus has recently been assigned to the Mitridae by Dall (Trans. Wag. Inst., Vol. 3, p. 95).

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